

APPENDIX E

EXCERPTS FROM "LESSONS LEARNED"

E-1. Introduction. The following list of lessons learned was compiled by the Committee on Tidal Hydraulics. The Committee selected 24 US Army Corps of Engineer navigation projects to develop case histories of a variety of projects and problems that have been investigated previously.

E-2. Background. There are several hundred Corps-constructed and -maintained navigation projects. These projects include deep-draft ship channels, small boat harbors, and intracoastal waterways. A number of these projects experience higher shoaling rates and therefore burdensome maintenance dredging requirements. One of the missions of the CTH is to provide consulting services to District offices on request to review problems and to make recommendations concerning possible causes and reduction/elimination of the problem.

E-3. Lessons Learned. The following list is a compilation of generic lessons learned from the estuarine projects reviewed by the CTH.

- a. Dredged channels or harbor facilities in naturally shallow water usually will require frequent maintenance dredging.
- b. Where possible, docks should be located in naturally deep water.
- c. An increase in channel depth usually will allow greater penetration of the saltwater wedge, which will move the shoaling location upstream.
- d. Either a decrease or an increase in freshwater inflow (due to upstream dam regulation or flow diversion) can alter the salinity characteristics of an estuary (increased intrusion length or increased stratification), which in turn can alter the location and rate of channel shoaling.
- e. Increased river discharge (by diversion) can increase sediment load available for shoaling in the estuary.
- f. Access channels and harbor areas off the main navigation channel should be streamlined to reduce eddies and deadwater areas where shoaling can occur.
- g. Unconfined disposal of clean material usually has no adverse long-term effects on the biological population. The dredged channel and submerged disposal will be recolonized in 1 or 2 years.
- h. Confined disposal will prevent the return of dredged material to the channel and reduce future channel shoaling.
- i. Adjustment (sloughing) of dredged channel slopes can increase maintenance dredging for several years following construction, especially in sand-type bottom materials.

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j. Isolation of the channel from sediment inflow by such training structures as dikes can reduce maintenance dredging.

k. Abandoning or relocation of projects should be considered when rapid shoaling prevents effective maintenance.

l. Change in bottom flow predominance can change volume and location of shoaling.

m. Piers on piling create eddies that increase shoaling rates of cohesive sediments.

n. Dredged disposal mounds should have relatively flat side slopes to reduce erosion. This will reduce return of material to active sediment system.

o. Suspended clay sediments can flocculate and cause shoaling with proper combination of salinity, water temperature, and flow conditions (e.g., low current velocities and slack-water periods). Flocculation is greatly accelerated by increases in the suspended sediment concentration.

p. Tide gates in secondary channels to divert ebb flow back to the main channel can aid flushing and reduce shoaling.

q. Controlled dredging and disposal practices can reduce the volume of sediment placed back in suspension. This will reduce the channel shoaling rate.

r. Expansions of harbor cross sections will reduce velocities, which can cause rapid shoaling.

s. Side channels, basins, and pier slips in estuaries are effective sediment traps.

t. Physical and/or numerical models can be very effective in studying a variety of problems, such as channel shoaling, tidal characteristics, salinity intrusion, flushing characteristics, channel alignment, training works, and flow diversions. (Various examples are cited in the preceding chapters and other appendices of this EM.)

u. Salinity behavior in many well- or partly mixed estuaries can result in a condition known as a turbidity maximum. This condition is caused by salinity-induced circulation patterns, resulting in a near-bottom flow predominance null point (no net flow in either direction). The zone of a turbidity maximum will often be subject to rather heavy shoaling; thus, this zone should be avoided when siting harbor facilities.

v. Since the inside of channel bends is usually an area of heavy shoaling, harbor facilities should be sited in the outside portion of bends.

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w. Although ship simulators represent a new technology that was not available during any of the studies reported in these case histories, they are very useful in studies of channel alignment (e.g., effects of crosscurrents), dimensions (e.g., depth and width required for navigation safety), and bridge crossings (e.g., location and width of navigation openings).

x. Open-water disposal should be in a dispersive site (scour hole) where movement is out to sea, unless the site is intended to be retentive.

y. Channel alignment changes to minimize maintenance dredging should also consider alignment for safe navigation and avoid channel migration, which could undermine control structures.

z. Trench-placed riprap constructed in the dry before channel excavation is a cost-effective way to stabilize the final channel side slopes.

aa. Agitation dredging and in-channel disposal can be effective where strong ebb flow dominance exists.

bb. Some jetty systems may take years to reach equilibrium (100 or more years).

cc. Upstream bottom flow predominance can increase channel shoaling.

E-4. Summary. The preceding list of generic lessons learned was compiled by the CTH based on the review of 24 specific Corps navigation projects. The lessons learned should assist in problem avoidance before undertaking a project design or modification.